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Technical Note N-504

SPECIFICATIONS FOR THE MODEL 40 SNOWPLANE

April 1963

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APR 1963  
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U. S. NAVAL CIVIL ENGINEERING LABORATORY  
PORT HUENEME, CALIFORNIA

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**SPECIFICATIONS FOR THE MODEL 40 SNOWPLANE**

**Y-F015-11-240**

**Type B**

**by**

**N. E. Pierce**

**ABSTRACT**

Outline specifications for procurement of special equipment for compaction of snow in polar regions are being prepared by the Laboratory. This Technical Note contains the specifications for the Model 40 snowplane presented in the Naval Civil Engineering Laboratory Technical Report R-110, Snow Compaction Equipment - Snowplanes.

This unit which is a ski-mounted, towed-type piece of equipment, is used for leveling and grading natural and compacted-snow areas. Its 40 foot span makes it suitable for use on medium-wave sastrugi, or wind-driven snow, where the crest-to-crest distance is less than 40 feet.

## INTRODUCTION

During the past ten years, the Naval Civil Engineering Laboratory has developed techniques and special equipment for compacting snow in polar regions. This development is now sufficiently advanced that outline procurement specifications are being prepared for the special equipment. This technical note contains the specifications for the Model 40 snowplane developed for this work.

The snowplane, which is a ski-mounted, towed-type piece of equipment, was developed for initial and final leveling and grading of compacted snow areas built with the Navy cold-processing snow compaction techniques.<sup>1</sup> The basic snowplane was developed around the Marvin Landplane Company, Woodland, California, line of commercial landplanes.<sup>2</sup> Two sizes of snowplanes have been built to date. One, with an 80 foot span, called a Model 80 snowplane, was developed after the Model 40 snowplane covered by this specification. The Model 80 snowplane was developed for use at interior locations in Antarctica where the sastrugi, or wind-driven snow has an extremely rough surface pattern. The Model 40 snowplane is considered more of a general use snowplane. Prototypes of both models have given excellent service with a minimum of maintenance during several thousand hours of use.

The Marvin Landplane Company Model 40 snowplane development was started in 1953. A Marvin Jr. 40 foot Landplane was modified by replacing the wheels with skis and shipped to Hardtop II for leveling compacted snow. Subsequent tests and modifications were made in the Model 40 snowplanes for operation Deep Freeze I in 1955 and the Squaw Valley Trials in 1958-60. In 1963, the Model 40 snowplanes in Antarctica were fitted with self-contained hydraulic power-pack units mounted on a platform just behind the operator's cab for improved performance. With this change, the supply lines extending to the tongue for energizing the snowplane with the tow tractor hydraulic system are not required and should be omitted from the snowplane. The design, which is detailed in Y&D drawings listed in the Appendix covers the latest modifications except the Hydraulic Power Pack, which is a commercially available unit.

### Specifications For The Model 40 Snowplane

#### 1. Scope

The contract shall provide the snowplane detailed in Bureau of Yards and Docks Drawings No. 813586 through 813598 of 1 September 1959 and revised in September 1960, and described in paragraph 2 below, and shall furnish all services and materials for its fabrication.

#### 2. Snowplane Details

The over-all length of the Model 40 snowplane with tongue shall be 57 feet plus or minus 4 inches; its width with the bowl/blade unit normal

to the frame, 12 feet; and its height, with cab not to exceed 9 feet. The gage between the skis shall be 7 feet 6 inches with the longitudinal distance between skis 40 feet 11-1/2 inches.

a. Frame. The frame shall be comprised of two upset trusses connected by joining the members and braced with diagonal tie rods. Each truss shall be made up of two 20-foot-long triangular-shaped welded angle sections and one trapezoid-shaped welded angle middle section. The middle section is 1 foot wide at the bottom, 1 foot 6 inches wide at the top and 2 feet 6 inches deep. These sections and all joining members are bolted together to form a frame 41 feet 5 inches long and 7 feet 6 inches wide.

b. Turntable. The turntable assembly shall be a standard commercial unit of lightweight construction similar or equal to the Pacific Number I Terracer or Galion 503 Turntable. Its support members shall be attached to the extension arm with pins and to the main cross member of the middle frame section with hydraulic cylinders. It shall be rotated with wire cable and a hydraulic cylinder.

c. Bowl/Blade. The blade unit shall be 11 feet 10 inches wide, 2 feet high and built on a 12 inch radius. It shall be mounted below the turntable for raising, lowering, rotating and tilting. Change-over from grader blade to planer bowl shall be accomplished by using single bolts to connect the wings to the ends of the frame extension arms and clip angles to rigidly connect the wings to the ends of the grader blade. Thus, the planer bowl shall be capable of being raised and lowered but not rotated or tilted.

d. Skis. Each ski shall be pinned to an axle which is set in a housing, fitted into each corner of the main frame. Each ski shall be permitted to oscillate in both a horizontal and vertical direction. The bottom of the skis are to be 6 feet long and 1 foot wide. The design is to be based on a maximum bearing pressure of 2.5 psi with no load on the snow plane and about 2.6 psi with an operator, hydraulic fluid and fuel aboard.

e. Tongue. The towing tongue shall be a 4 inch square box section 11 feet 5 inches long, connected to the front frame member through a yoke for vertical and horizontal movement.

f. Steering. The front set of skis shall be connected to the tongue through a tie bar and pivot arm for steering by the tow tractor. The rear set of skis shall be connected to a hydraulic cylinder through a tie bar and pivot arm for power steering. A steering wheel is also available for manually steering the rear ski when power is not available.

g. Hydraulic System. The hydraulic system shall consist of a power unit, a multiple-unit control valve, four hydraulic cylinders and all necessary connections. The hydraulic power unit shall be mounted on a platform just behind the operator's cab: the control valve shall be located in front of the operator's cab and shall be connected in such a manner that the operator can individually control the rear steering cylinder, the blade pivot cylinder and the two blade elevating/tilting cylinders. Except as noted below, extra strong black pipe shall be used for all hydraulic lines. It shall be fastened to the frame members in such a manner that it can be left in place when the snowplane is disassembled. Low-temperature hydraulic hose and quick-disconnects shall be used for all disassembly points in the hydraulic lines and for connection of these lines to the hydraulic power unit. The hydraulic hose shall conform to Military Specification MIL-H-8794 and shall be usable to -65 degrees Fahrenheit. The quick-disconnects, Snap-tite or equal, shall be used to attach the hoses to the pipe, cylinders and power unit.

h. Hydraulic Power Unit. The hydraulic power unit shall consist of a hydraulic package and liquid-cooled, gasoline-driven engine enclosed in an all-weather compartment fitted with remote-controlled radiator shutters and sliding or hinged access doors. The hydraulic package shall be similar or equal to a Vickers PK6-2000-0-12 pump, a CM-11-0020 RDDDDL Valve, a TMI-64-1-10 reservoir and CM 11-H-10 handles. It shall be fully equipped with necessary piping, pump spacers, suction filter, baffle, oil-level gage, filler cap and breather assembly. The gasoline engine shall be of a standard make similar or equal to a Continental Model V 69, 20HP, 1400 rpm, 12 volt, liquid-cooled unit complete with radio interference shielding, hand clutch and power take-off. A flexible coupling shall be used to connect this hydraulic pump to the power take-off on the engine. The ignition system on the engine shall be shielded in compliance with Military Specifications MIL-1-16165C and MIL-1-6181B. An insulated battery box located for easy access shall be provided for the 12 volt, dry charged type 6TN battery to be furnished with this unit. The control panel on the hydraulic power unit shall be so located that it is readily accessible from the rear window of the cab.

i. Operator Cab. A standard commercial cab similar or equal to a Model D Allis-Chalmers road grader cab which has been insulated for cold weather use shall be provided with the snowplane. It shall be fitted with a sliding rear window, a plywood floor, a bucket seat, and a 12-volt Kysor Model TC Assembly K 630 or equal hot water heater and front windshield defroster. The cab shall be bolted to the frame of the snow plane in such a manner that it can be quickly removed for shipment. The heater shall be connected to the liquid coolant system of the hydraulic power unit gasoline engine with low temperature hose conforming to Military Specifications MIL-H-8794. The hydraulic control valve at the front of

the cab shall be so located that it can be activated by the operator from either a standing or sitting position.

j. Treatment and Painting. The snowplane shall be treated and painted in accordance with the paint manufacturer's procedures, using No. 12197 orange gloss conforming to Federal Standard 595.

### 3. Packaging

On short truck hauls the Model 40 snowplane can be shipped with only partial disassembly. This entails removing the tongue, bowl/blade unit and bowl wings and folding back the ends of the extension arms. The cab and hydraulic power pack may remain in place, but the four ski assemblies are removed by dropping the ski axles from the axle housings after removal of steering arm bolts. This results in a package 40 feet 11-1/2 inches long, 8 feet wide and 9 feet high that weighs approximately 8500 lbs and occupies 2228 cubic feet. For transportation by cargo aircraft and ship, the snowplane must be completely disassembled. In complete disassembly the snowplane is packaged into eight crates with a total weight of approximately 11,200 pounds and it occupies approximately 1300 cubic feet. All packaging shall conform to the crating standards for overseas surface shipments.

## REFERENCES

1. U. S. Naval Civil Engineering Laboratory. Technical Report R-114 "Snow Compaction - Techniques", by E. H. Moser, Jr., Port Hueneme, California, 29 June 1962.
2. U. S. Naval Civil Engineering Laboratory. Technical Report R-110 Supplement, "Snow Compaction Equipment Snowplanes", by E. H. Moser, Jr., Port Hueneme, California, 9 February 1961.

## Appendix

### Snow Compaction Equipment - Model 40 Snowplane

(The originals of these drawings are available at the Naval Civil Engineering Laboratory, Port Hueneme, California. All drawings are 28 by 40 inches).

<u>Y&amp;D Drawing No.</u>	<u>Title</u>
813586	General Assemblies
813587	Frame Middle Insert Assemblies and Details
813588	Tongue and Hitch Assembly and Details
813589	Bowl Assemblies and Details
813590	Turntable Modifications Assemblies and Details
813591	Bowl Wing Assembly and Details
813592	General Details
813593	Cab Modifications
813594	Runner and Steering Assemblies and Details
813595	Frame Assembly and Details
813596	Hydraulic Control System Assembly and Details
813597	Hydraulic Control System Pipe Supports and Details
813598	Hydraulic Control System Miscellaneous Details